PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Improvements in or relating to Pneumatic Tyres

We, PNEUMATIQUES, CAOUTCHOUC MANUFACTURE ET PLASTIQUES KLEBER COLOMBES, a French body corporate of Place de Valmy, Colombes, Seine, France do hereby declare the invention, for which we pray that a patent may be granted to us and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to pneumatic tyres and more particularly to a bead for tyres.

The invention consists in a pneumatic tyre wherein at least some of the carcass plies in each bead region are folded radially outwardly about a bead wire or bead wires and the turned up parts thereof extend radially outwardly in the sidewall of the tyre and are arranged in a stepped configuration, with the radially outermost edge of said carcase plies arranged in the stepped configuration disposed substantially in the plane of greatest axial width of the tyre section, and wherein all the reinforcing strips for the bead are arranged in such a manner that their radially outer edges are disposed at different radial levels and radially inwardly of the edges of said carcase plies arranged in stepped configuration, said reinforcing strips being coated with relatively hard (as hereindefined) rubber mixtures.

In order that the invention may be more easily understood, reference will now be made to the accompanying drawings in which:

Figure 1 is a radial section containing the axis of a tyre, and

Figure 2 is a radial section containing the axis of the bead of a tyre constructed in accordance with the present invention.

The present invention is especially suitable for giant tyres such as truck tyres having a radial cord type carcase 1 and a breaker structure 2, such as that shown in Figure 1.

It is known that tyres of this type have side walls which are very flexible and which flex considerably under load. This considerable flexing and the stresses due to driving and braking torques which are imposed on the side-walls result, in the case of giant tyres, in premature deterioration of the radially inner parts of the sidewalls adjacent the beads, in which areas separation between the plies of fabric and rubber is often experienced.

The general problem encountered when it is desired to construct a bead is so to arrange the construction that the rididity between on the one hand, the radially inner part of the bead which is embedded in a rubber chafer strip and is reinforced by one or more rigid metal bead wires 3 (Figure 1) and, on the other hand, the radially inner part of the sidewall 4 which must be flexible in order to bend elastically under load. This is achieved by a shaping of the bead, the thickness of which decreases progressively to the thickness of the sidewall. To this end the rubber filler 5 which usually surmounts the bead wire is given a triangular form, which tapers towards the radially outer edge of the filler, and the edges of the carcass plies turned up about the bead wires are arranged in a stepped configuration.

However, this general arrangement is often insufficient to ensure sufficient resistance of the beads to wear and tear, especially in the case of giant tyres of the type mentioned, owing to the considerable amplitude of flexing of the sidewalls. Research has thus been carried out and attempts have been made to improve tyres by modifying details of the relative arrangements of the constituent elements of the tyre, but is is very difficult systemmatically to test all possible combinations due to their larger number and because these tests are costly and the process of deterioration is difficult to determine with accuracy in each case.

In spite of these difficulties, a construction

according to the invention, is suitable for tyres of the type under consideration and is particularly suitable where the reinforcing plies of the carcass 1 comprise parallel textile cords or cables.

With the construction of the invention, a tyre construction is obtained which is of relatively pronounced stiffness as far as the radially inner part of the sidewall and thus the zone of greatest flexing of the sidewall is at its radially outer part whilst a suitable decrease of the stiffness is achieved owing to the stepped configuration of the edges of the carcass plies and the edges of the reinforcing elements.

The reinforcing strips may comprise one or more flippers and/or flat stiffening strips. The edges of the carcass plies may then be arranged in the stepped configuration between the radially outer edge or edges of the flipper or flippers and the plane of greatest axial width of the tyre section.

Preferably, a rubber filler located radially outwardly of the bead wire or wires projects radially beyond the radially outer edge or edges of the flipper or flippers.

When the reinforcing strips comprise flat metal stiffening strips located axially outside the carcass plies, they radially outer edges of these strips are located intermediate the radially outer and inner edges of the flipper or flippers.

Referring now to Figure 2, which illustrates one embodiment of the invention, the bead shown comprises a single inextensible reinforcing bead wire 10 surmounted by a rubber filler 11, the assembly being partially enclosed by a flipper 12 constituted by parallel cords, cables or wires, preferably metal wires, embedded in a calendered layer of rubber mixture. The wires are at an angle of 20 to 45° with respect to the longitudinal direction of the strip forming the flipper. The carcass of the tyres comprises several plies of radially disposed parallel textile cords or cables, these plies being calendered in the conventional manner with rubber mixture. In the bead region, the carcass plies are divided into two equal or unequal groups, one of which, group 13, extends down the axially inner side of the filler 11 and is turned up outwardly about the wire 10 and back on itself along the axially outer side of the flipper 12. The other group of plies, group 14, extends radially inwardly in contact with stepped edges of the plies 13 and extends to the toe 15 of the bead so that, together with the plies 13, the bead is formed in two directions about the wire. The group of plies 14 have a stepped configuration adjacent the toe 15.

Located on the outside of the external group 14 of carcass plies are two flat stiffening strips 16, which preferably comprise metal wires or cables similar to the flipper 12, the direction of the wires of one strip being at an angle of 20 to 45° to those of the other. A rubber cushion 17 is interposed between the strips 16 and the plies 14. The latter are exteriorly protected by a side wall 18 of rubber and the plies 13 are protected by an internal liner 19, which is composed of a mixture very impermeable to air in the case of a tubeless tyre. The inner edges of the side wall 18 and the liner 19 are inserted behind a rubber chafer strip 20 which covers the lower part of the bead and protects it from rubbing against the raised edge of the wheel rim.

The elements referred to above are conventional and the invention relates essentially to their relative arrangement in order to obtain the required results. In this arrangement the edges 13_1, 13_2, 13_3 . . . of the carcass plies 13 form a series of steps between the level of the edge 12_1 of the flipper and the radial level of the plane P of greatest axial width of the tyre section. The edges 12_1 and 12_2 of the flipper 12 are themselves located at different radial levels. The axially outer edge 12_1 is preferably located radially outwardly of the axially inner edge 12_2 and is located between the assembly formed by the group of carcass plies 13 and the filler 11. The edge 12_1 of the flipper is located substantially in the neutral-stress zone of the bead when it flexes: i.e. the median part of the bead which is not subjected to compression or tension when the bead is flexed. Moreover, the radially outer edges 16_1 of the strips 16 are located at an intermediate radial level between the edges 12_1 and 12_2 of the flipper. Finally, the radially outer edge of the bead cushion 17 extends radially outwardly of the level of the edges 16_1 of the strips and is thus located between the edges 12_1 of the flipper and the edges 16_1 of the strips 16. Contrary to conventional practice, the rubber filler 11 extends radially outwardly, tapering beyond the radially outer edge 12_1 of the flipper.

The arrangement described produces a satisfactory tyre, using relatively hard rubber mixtures, that is, those in which the modulus of elasticity at 100% extension is greater than 35 kg/cm² (measured according to the ASTM D412—61T standard), these mixtures being obtained by the addition of suitable proportions of active or inert fillers, including fibres. Thus, the rubber mixtures serving for the calendering of the carcass plies 13 and 14, the flipper 12 and the strips 16 preferably have a modulus of elasticity of the order of 45 kg/cm². In the same manner the bead cushion 17 is of relatively hard rubber. These rubber mixtures co-operate with the various bead reforcing elements in order to make it particularly rigid as far as the radially inner part of the side wall of the tyre in such a manner that vertical flexing of the sidewall is localised principally to the radially outer part of

the sidewall, that is radially outwardly of the plane P of the greatest axial width. However, these mixtures do not oppose the propressive decrease in rigidity of the bead obtained with the stepped configuration of the edges of the carcass plies and the edges of the various reinforcing elements therebetween and in respect of the rubber filler.

Whilst a particular embodiment of the invention has been described, it will be understood that various modifications can be made without departing from the scope of of the invention as defined by the appended claims. For example, certain elements of the above construction may be increased, decreased or omitted as is necessary to produce tyres of greater or smaller dimensions.

WHAT WE CLAIM IS:—

1. A pneumatic tyre wherein at least some of the carcass plies in each bead region are folded radially outwardly about a bead wire or bead wires and the turned up parts thereof extend radially outwardly in the sidewall of the tyre and are arranged in a stepped configuration, with the radially outermost edge of said carcass plies arranged in the stepped configuration disposed substantially in the plane of greatest axial width of the tyre section, and wherein all the reinforcing strips for the bead are arranged in such a manner that their radially outer edges are disposed at different radial levels and radially inwardly of the edges of said carcass plies arranged in stepped configuration, said reinforcing strips being coated with relatively hard (as herein-defined) rubber mixtures.

2. A tyre as claimed in claim 1, wherein the reinforcing strips comprise one or more flippers and/or flat stiffening strips.

3. A tyre as claimed in claim 2, wherein the axially outer edge of the or each flipper projects radially outwards beyond the axially inner edge thereof.

4. A tyre as claimed in claim 2 or 3, wherein the edges of said carcass plies are arranged in the stepped configuration between the radially outer edge or edges of the flipper or flippers and the plane of greatest axial width of a tyre radial section containing the tyre axis.

5. A tyre as claimed in claims 2, 3 or 4, wherein a filler located radially outwardly of the bead wire or wires projects radially outwardly beyond the radially outer edge or edges of the flipper or flippers.

6. A tyre as claimed in claims 2, 3, 4 or 5, wherein the radially outer edge of the or each stiffening strip is located intermediate the edges of the flipper or flippers.

7. A tyre as claimed in claim 6, wherein the axially outer edge of the or each flipper is located in the neutral-stress zone (as herein defined) of the bead.

8. A tyre as claimed in Claim 2 or any one of the preceding claims dependant thereto, wherein a bead cushion of relatively hard mixture (as herein defined) is interposed between the stiffening strip or strips and the carcass plies, the radially outer edge of said cushion being located intermediate the radially outer edges of the stiffening strip or strips and the flipper or flippers.

9. A tyre as claimed in any one of the preceding claims, wherein the reinforcing strips of the bead are calendered with a relatively hard (as herein defined) rubber mixture.

10. A tyre as claimed in any one of the preceding claims, wherein the carcass plies are calendered with a relatively hard (as herein defined) rubber mixture.

11. A tyre as claimed in any one of the preceding claims, wherein the carcass plies are divided, in the bead, into two groups which are folded about the bead wire or wires in opposite directions.

12. A tyre as claimed in any one of the preceding claims, wherein each bead comprises a single inextensible wire.

13. A tyre as claimed in any one of the preceding claims, wherein the reinforcing strips comprise parallel cords, cables or wires.

14. A pneumatic tyre constructed substantially as hereinbefore described with reference to Figure 2 of the accompanying drawing.

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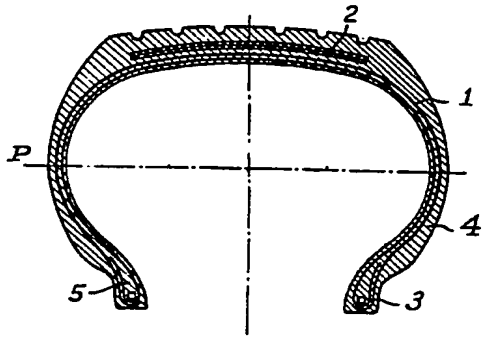
1 SHEET This drawing is a reproduction of the Original on a reduced scale

Fig. 1



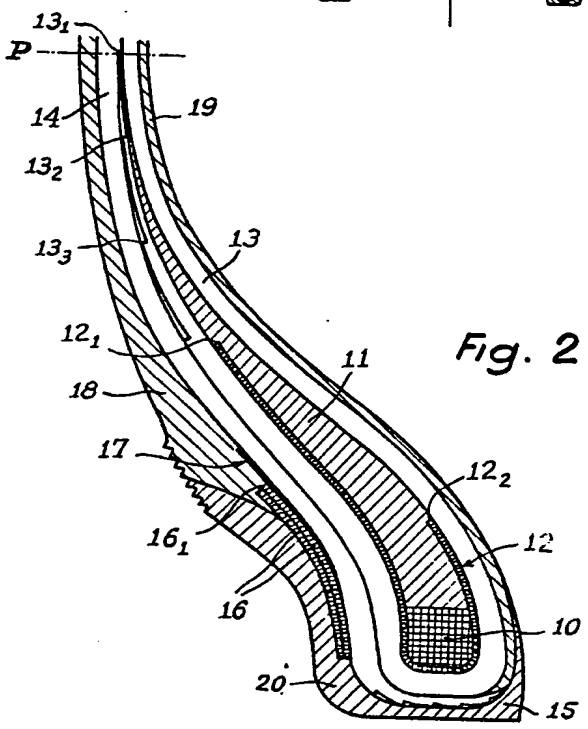


Fig. 2